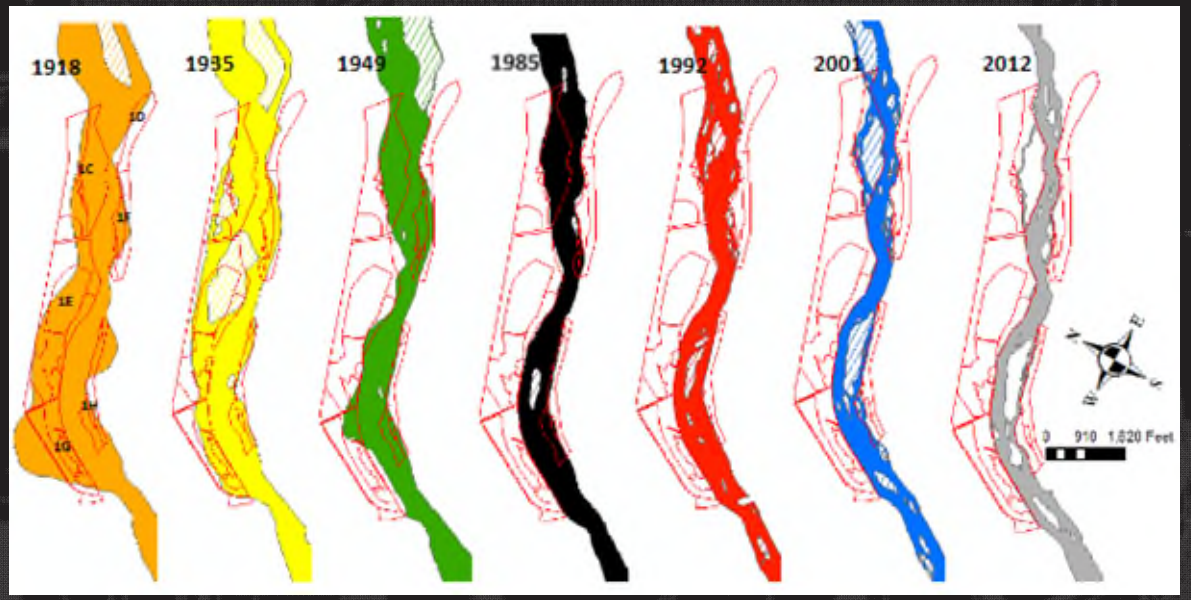
RETROSPECTIVE: TRANSITIONING RIVER GEOMORPHOLOGY AND ITS IMPACT ON HABITAT MANAGEMENT



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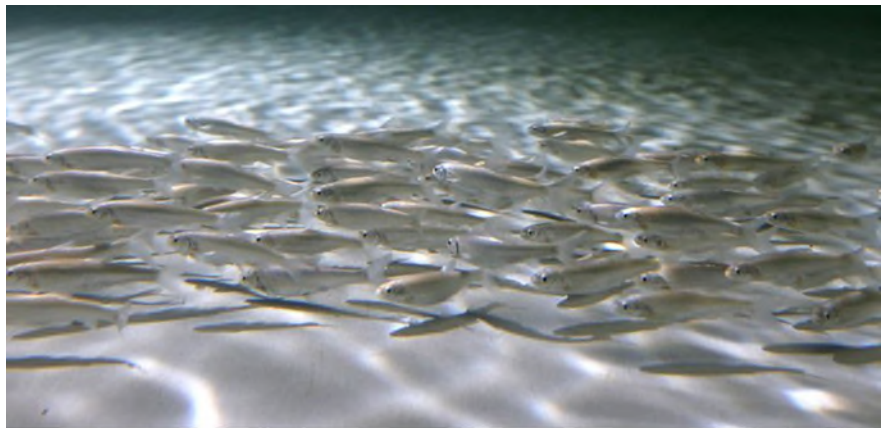
OVERVIEW

Problem Statement: How may we better incorporate observed geomorphic trends into habitat management and planning?

- Background and Case Study
- Limitations in current habitat management
- Proposed alternative approach
- Overcoming challenges
- Conclusion

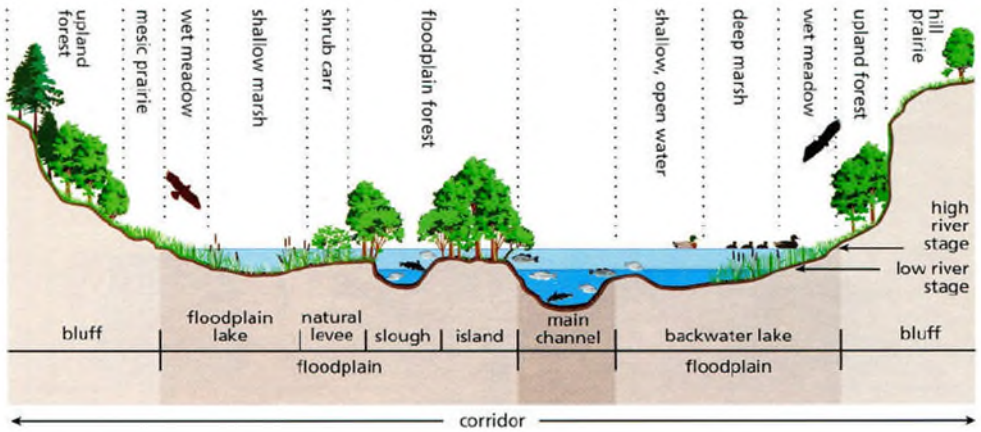
CASE STUDY: RIO GRANDE

- USACE, USBR and other agencies have interests:
  - Water delivery
  - Flood control
  - Recreation
  - Endangered species
- Conditions applies to other systems, i.e., alluvial materials; heavily managed: levees, dams, channelization.

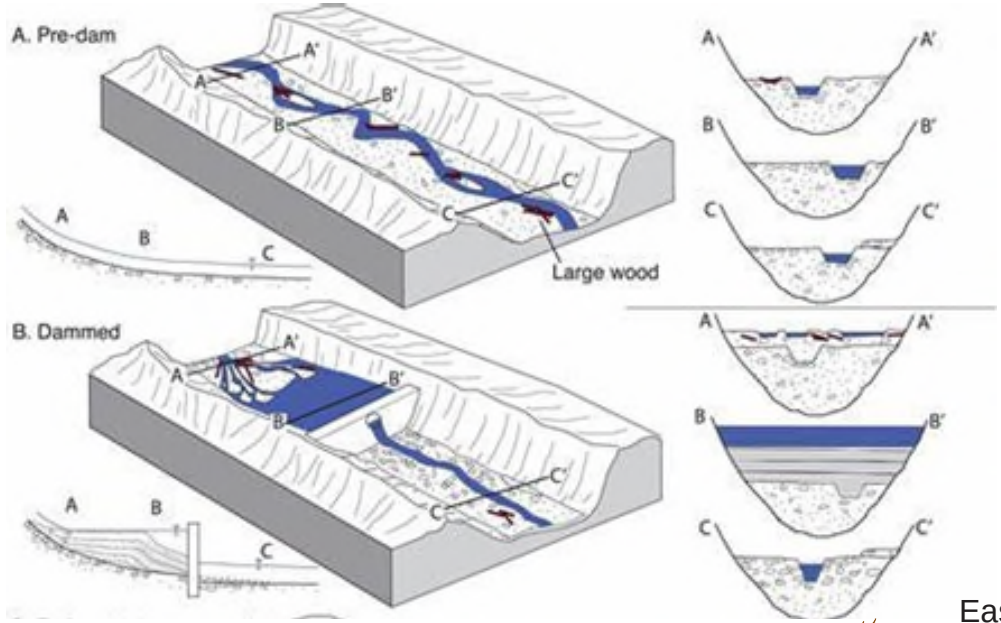


TRANSITIONING RIVERS

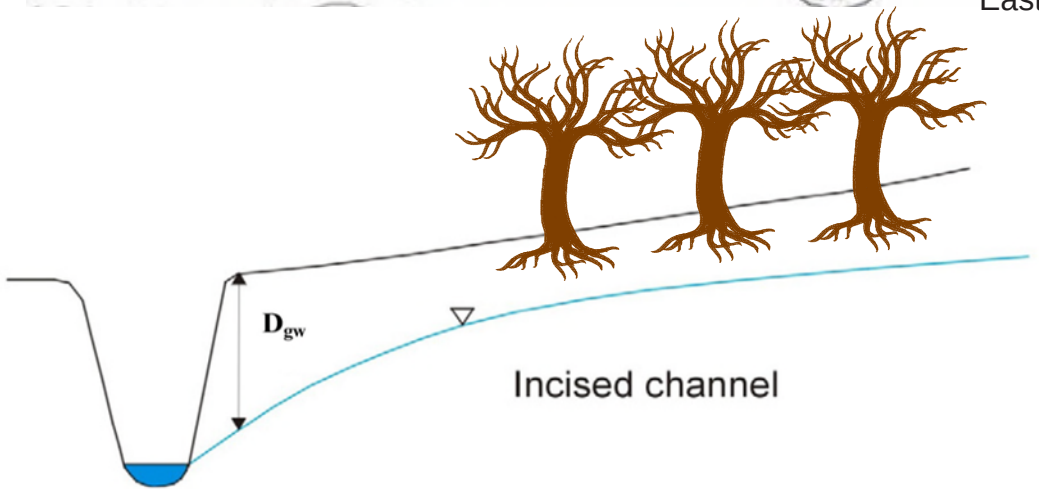
ORIGINAL CONDITION



CONSTRUCTED CONDITION



East et al. 2018



CURRENT RESTORATION STRATEGIES

Floodplain Restoration in the Rio Grande, 2019 (McKenna, Caplan)

Strategy Types:

- Bankline terrace;
- Side channels;
- Embayments/Backwaters;
- Vegetation removal etc.

Findings from annual monitoring:

- Sedimentation after first large event (3000 cfs); slower accretion after subsequent events.
- Narrowing of side channels;
- Inlet/outlet sedimentation.

Systemic Constraints:

- Project footprint based on excavation extents;
- Limited project life cycle;
- Maintenance demands.

NEED FOR AN ALTERNATIVE FRAMEWORK

Limitations of the Current Approach:

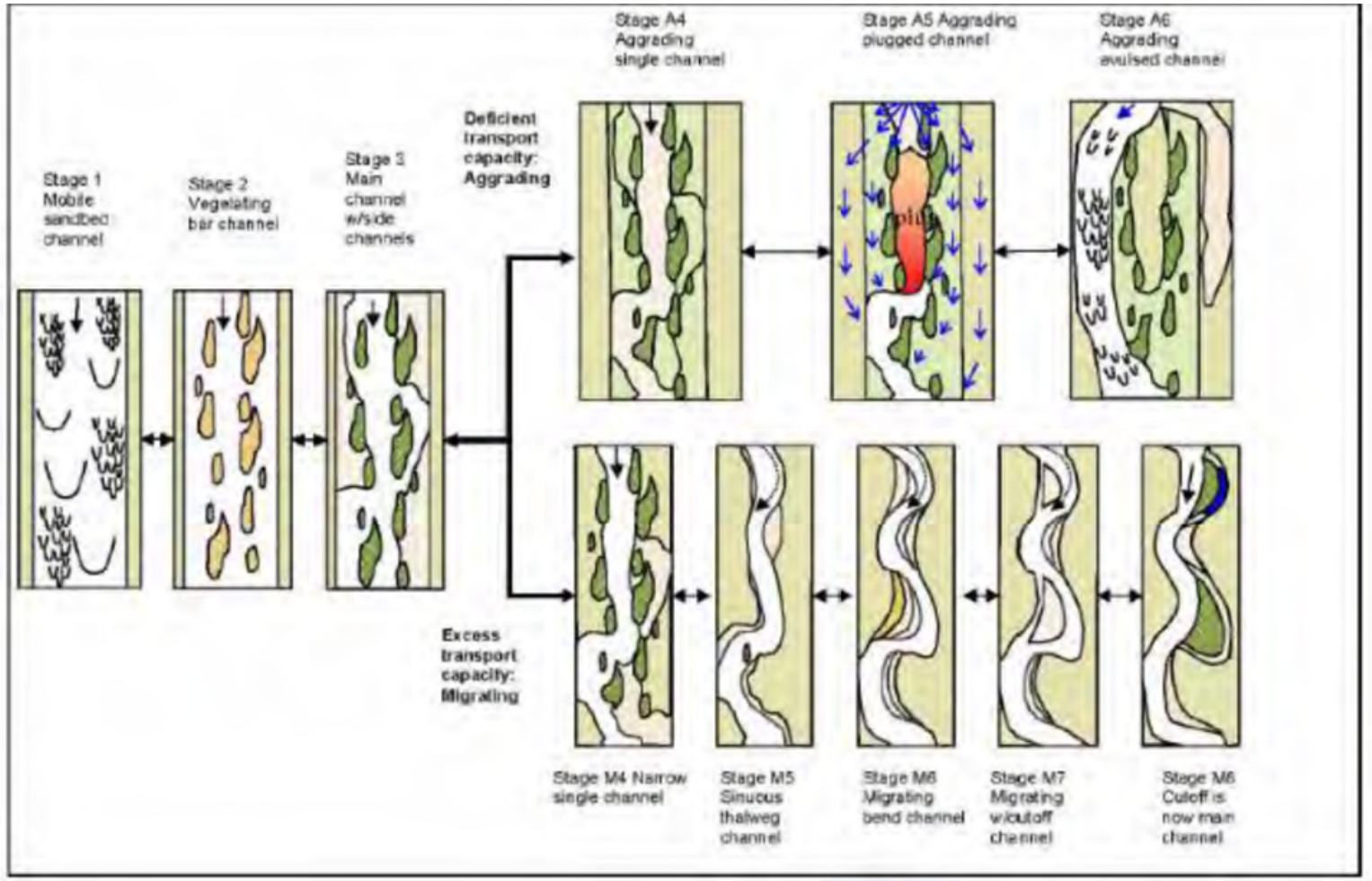
1) Narrow focus
    - Endangered species v. ecosystem; v. other system concerns;
    - Design flow v. flow frequency;
2) Short Term Plan
    - Performance expectations requiring recurring maintenance;
    - Definition of “No Action”.

Recommendations to the Restoration Planning Framework

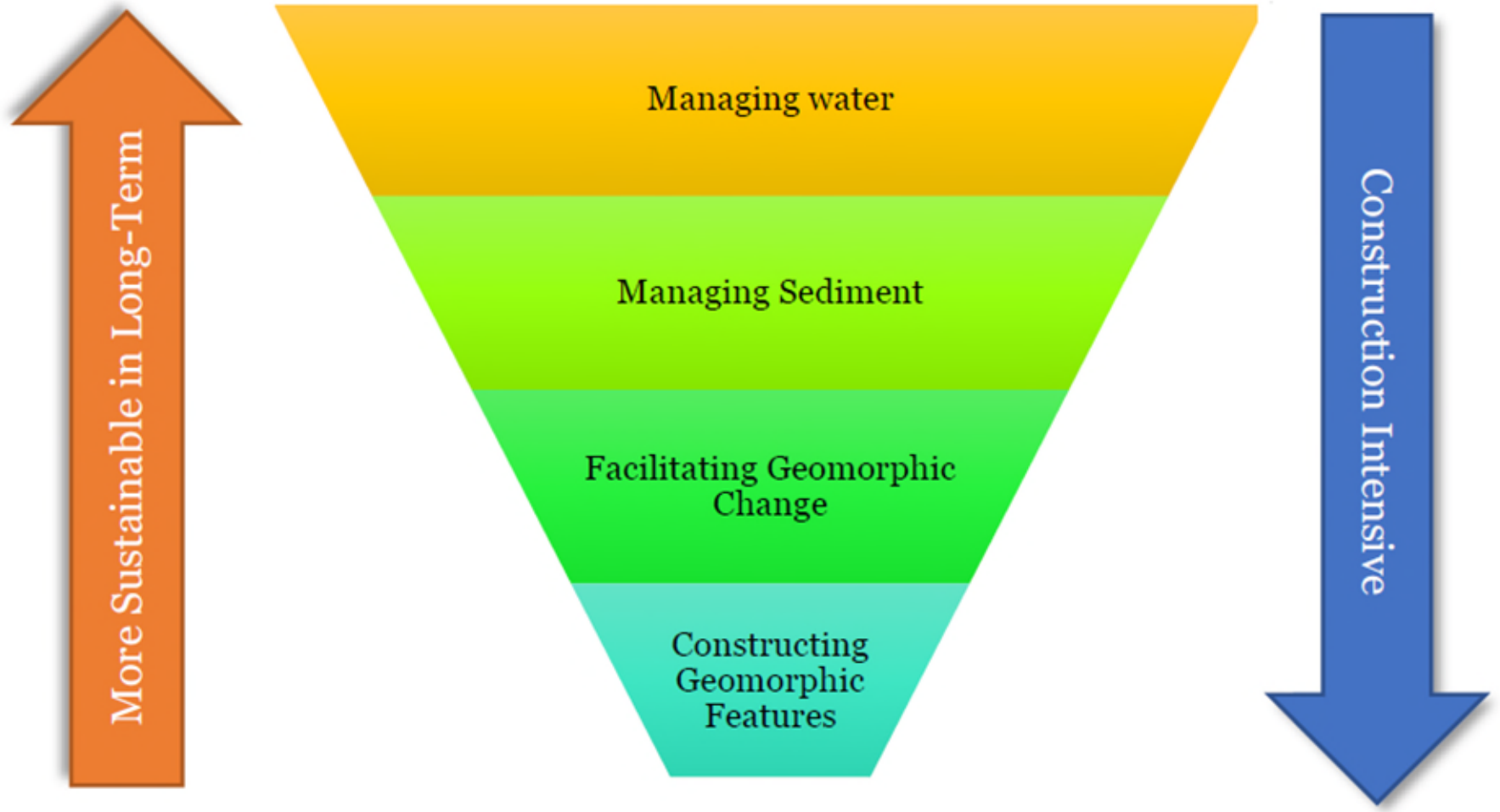
- Use of Conceptual Models in Planning;
- Categories based on Change Influence:
    - (4) Restoration Categories;
    - Examples and Caveats.

CONCEPTUAL MODELS IN PLANNING

- Applicable to problem formulation, alternatives analysis, value engineering, implementation and monitoring.
- Can be qualitative, semi-quantitative, fully quantitative.
- Use conceptual models to define:
  - Drivers of change/degradation.
  - Ecosystem processes.
  - Expectations and realistic goals.
  - Key uncertainties.



RESTORATION CATEGORIES BASED ON CHANGE INFLUENCE



CONSTRUCTING GEOMORPHIC FEATURES

- Earth work and constructed features emulate ideal geomorphic configurations.
- Most typical approach.
- **Examples:** Excavated side-channels, backwaters, and bankline terraces.
- Considerations:
  - Not the scale nor influence to sustain themselves; require maintenance.
  - Provided habitat areas are proportional to excavation footprints, requiring construction $$ to increase project impact.

FACILITATING CHANGE

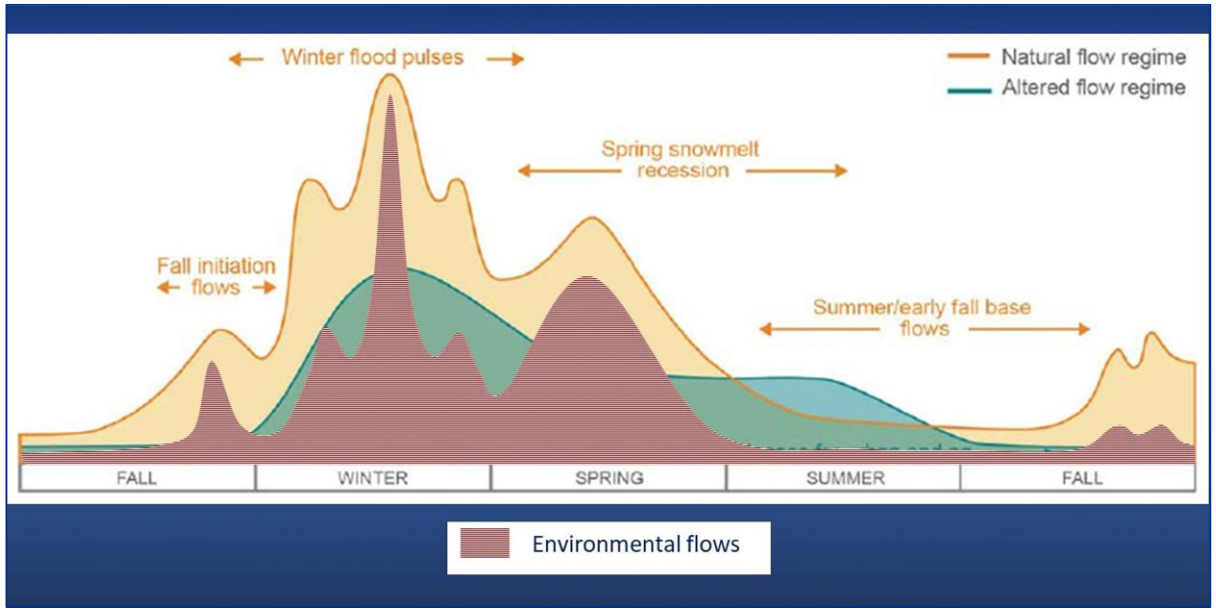
- Set up the river to do the work.
- **Examples:**
  - Levee improvement to allow higher flows;
  - Levee setbacks;
  - Channel reconstruction;
  - Woody debris;
  - Island formation;
  - Vegetation clearing;
  - Temporary WSE structures.

MANAGING SEDIMENT

- Controlling sediment supply, allowing river to deposit or scour.
- Reverting from man-made channels, retention structures.
- **Examples:**
  - Reduce sediment retention; sustainable sediment management.
  - Beneficial placement of dredged material.
  - Incorporate deposition in design.
- **Considerations:**
  - Natural sediment pulses may be associated with summer events (not snowmelt runoff).
  - Affects energy sources: macro invertebrates, biofilms.
  - May require contaminant analysis.

MANAGING WATER

- Streamflow affects geomorphic features, riparian environment.
- **Examples:**
  - Environmental flow releases: Timing, magnitude, duration, recession.
  - Influencing geomorphic change: flood; drought.
- **Considerations:**
  - Climate and land-use change may make required water volumes scarce.
  - Water management authorities may not allow habitat use.
  - May be secondary benefits to flood control or water delivery: i.e., reduced maintenance.



OVERCOMING CHALLENGES (1/2)

How to Prioritize Habitat Management:

- Address adjacent river priorities (flood control and effective conveyance);
- Leverage authorities.

How to make an Economic case:

- Identify functions for project life cycle (may change over course of project);
- Increase impact with multi-purpose projects;
- Capture Ecosystem Goods and Services and other less tangible benefits.

OVERCOMING CHALLENGES (2/2)

Public Communication:

- Resistance to change;
- Public perceptions/expectations;
- Education/Outreach.

Risk of failure:

- Plan-Do-Check-Act;
- Uncertainty v. acceptable risks.

RESEARCH HORIZONS

- Collaboration tools for:
  - Collaborative Program;
  - Navigating social science in flood mitigation projects;
  - TEK in Restoration Design.
- Engineering with Nature: Riverine islands.
- Sustainable sediment management and impacts to aquatic ecology.
- Machine Learning for hydrology & hydraulics in ecological models.

CONCLUSION

- Geomorphic change should be embedded into restoration planning.
- River engineering and habitat management link with multiple system issues.
- Opportunities to reduce economic costs and increase long-term effectiveness.

QUESTIONS?

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